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(71)Applicant : SONY CORP

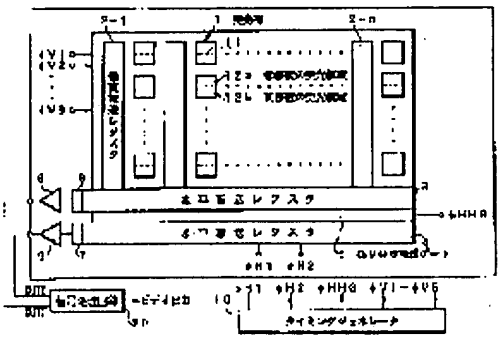
(72)Inventor : HARADA KOICHI

(54) SOLID-STATE IMAGE PICKUP DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an image pickup device in which the dynamic range is expanded without generating fixed pattern noise resulting from unevenness of saturated charge amounts Qs of each picture element.

SOLUTION: Each light receiving section 1 is divided into two light receiving areas 12a, 12b whose sensitivity differs from each other, among signal charges read from the two light receiving areas 12a, 12b of each light receiving section 1, signal charges of the light receiving areas with the same sensitivity in adjacent light receiving sections are mixed in vertical transfer registers 2-1-2-n and the mixed charges are transferred vertically and the signal charges in the light receiving areas with different sensitivity are transferred separately horizontally while being distributed to two horizontal transfer registers 3, 4 by a distribution transfer gate 5, the charges are converted into a signal voltage by charge detection sections 6, 7 and the converted voltage is fed to an external signal processing circuit 30, in which the signal with higher sensitivity is clipped and the resulting signal is added to a signal at a lower sensitivity to obtain a video signal output.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It is the so-called extensive dynamic range CCD with a large dynamic range [as opposed to an optical input in especially this invention] (Charge Coupled Device) about a solid state camera. It is related with a solid state camera.
[0002]
[Description of the Prior Art] Since the signal output based on this signal charge becomes fixed after the signal charge which photo electric conversion was carried out to the shape of a matrix, and was accumulated in it in each pixel (light sensing portion) by which two-dimensional arrangement was carried out overflows with CCD solid state cameras from a pixel, the signal output corresponding to the amount of incident light more than the saturation level of a pixel is not obtained, therefore the dynamic range to an optical input is narrow.
[0003] Two kinds of pixels from which sensibility differs as shown in drawing 18 in order to expand this dynamic range, For example, adjoin perpendicularly and the high sensitivity pixel 101 and the low sensibility pixel 102 are arranged by turns. After hanging a limiter within a pixel about the signal charge of the high sensitivity pixel 101, it reads to the perpendicular transfer register 103. The Ushiro perpendicular transfer of the signal charge of the high sensitivity pixel 101 and the signal charge of the low sensibility pixel 102 is mixed and carried out within the register 103 concerned. After carrying out a level transfer, supplying the charge detecting element 105 and changing into an electrical signal with the level transfer register 104 furthermore here, there is a solid state camera of a configuration of having made it output through a buffer 106 (for example, refer to JP,3-117281,A).
[0004] In this CCD solid state camera, if it becomes more than a constant rate with the amount of incident light, since a limiter will start the signal charge of the high sensitivity pixel 101, it is mixing the signal charge of this high sensitivity pixel 101, and the signal charge of the low sensibility pixel 102, and the input-output behavioral characteristics of polygonal-line approximation of the place shown in drawing 19 are obtained, and extensive dynamic range-ization is realized by this.
[0005]
[Problem(s) to be Solved by the Invention] However, in the high sensitivity pixel 101, actually, for every pixel, since the nonuniformity of dispersion and the amount Qs of saturation charges of each pixel has the large overflow property, as shown in drawing 20 , in the conventional CCD solid state camera of the above-mentioned configuration which hung the limiter for every pixel, offset arises in the input-output behavioral characteristics of polygonal-line approximation. Therefore, when it was the amount of incident light with which the high sensitivity pixel 101 is saturated, there was a problem that a fixed pattern noise (nonuniformity of a fixed pattern) occurred in an image according to the nonuniformity of the amount Qs of saturation charges which is each pixel being large.
[0006] Then, this invention aims at offering the solid state camera which enabled expansion of a dynamic range, without generating the fixed pattern noise resulting from the nonuniformity of the amount Qs of saturation charges of each pixel.

[0007]
[Means for Solving the Problem] Two or more light sensing portions by which they consisted of two or more light-receiving fields where each sensibility differs while at least 2 ****s of the solid state cameras by this invention were carried out by the channel stop field and they had opening independently respectively, and two-dimensional arrangement was carried out at the shape of a matrix, The inside of the signal charge which was allotted for every vertical file of two or more of these light sensing portions, and was read from each of two or more light-receiving fields for every light sensing portion, Two or more perpendicular transfer registers which mix and carry out the perpendicular transfer of the signal charges of the light-receiving field of the sensibility with the same adjacent light sensing portion, Two or more level transfer registers which carry out a level transfer with these two or more perpendicular transfer registers separately in response to the fact that the signal charge of the light-receiving field where the sensibility transmitted in order differs, Two or more charge detecting elements which detect the signal charge transmitted with these two or more level transfer registers, and are changed into an electrical signal, The output signal based on signal charges other than the signal charge of the light-receiving field of figure of merit is clipped at least among each output signal of two or more of these charge detecting elements. It has composition equipped with the digital disposal circuit which adds and outputs this clipped signal and the output signal based on the signal charge of the light-receiving field of other sensibility.
[0008] In the solid state camera of the above-mentioned configuration, the amounts of charges by which photo electric conversion is carried out in each light-receiving field to the same incident light because the sensibility of two or more light-receiving fields of each light sensing portion differs respectively differ. Each signal charge of two or more light-receiving fields is read from these light sensing portions to a perpendicular transfer register for every light sensing portion. The signal charges of the light-receiving field of the sensibility with the same light sensing portion which adjoins each other among this read signal charge can distribute corresponding to the light-receiving field which was mixed within the perpendicular transfer register and where a Ushiro perpendicular transfer is carried out and sensibility differs in two or more more level transfer registers, and a level transfer is separately carried out, and they are changed into an electrical signal by the charge detecting element. And in a digital disposal circuit, the output signal based on signal charges other than the signal charge of the light-receiving field of figure of merit clips at least among each output signal of a charge detecting element, and it is added with the output signal based on the signal charge of the light-receiving field of sensibility besides after an appropriate time.
[0009] Two or more light sensing portions by which they consisted of two or more light-receiving fields where each sensibility differs while at least 2 ****s of other solid state cameras by this invention were carried out by the channel stop field and they had opening independently respectively, and two-dimensional arrangement was carried out at the shape of a matrix, The inside of the signal charge which was allotted for every vertical file of two or more of these light sensing portions, and was read from each of two or more light-receiving fields for every light sensing portion, Two or more perpendicular transfer registers which mix and carry out the perpendicular transfer of the signal charges of the light-receiving field of the sensibility with the same adjacent light sensing portion, Two or more level transfer registers which carry out a level transfer with these two or more perpendicular transfer registers separately in response to the fact that the signal charge of the light-receiving field where the sensibility transmitted in order differs, Signal charges other than the signal charge of the light-receiving field of figure of merit are clipped at least among the signal charges transmitted with these two or more level transfer registers, and it has composition equipped with the output section which mixes and outputs this clipped signal charge and the signal charge of the light-receiving field of other sensibility.
[0010] In other solid state cameras of the above-mentioned configuration, the signal charges of the light-receiving field of the sensibility with the same light sensing portion which adjoins each other like the case of a previous solid state camera among the signal charges read from each of two or more light-receiving fields for every light sensing portion can distribute corresponding to the light-receiving field which was mixed within the perpendicular transfer register and where a Ushiro perpendicular transfer is

carried out and sensibility differs in two or more more level transfer registers, and a level transfer is separately carried out. And in the output section, signal charges other than the signal charge of the light-receiving field of figure of merit clip at least among the signal charges by which the level transfer was carried out, and the signal charge of the light-receiving field of sensibility besides after an appropriate time is mixed.

[0011]

[Embodiment of the Invention] Hereafter, it explains to a detail, referring to a drawing about the gestalt of operation of this invention. Drawing 1 is the outline block diagram showing 1 operation gestalt of this invention. In drawing 1 , two-dimensional arrangement of two or more light sensing portions (pixel) 1 which change and accumulate incident light in the signal charge of the amount of charges according to the quantity of light is carried out at the shape of a matrix. These light sensing portions 1 are constituted by the channel stop field 11 by two light-receiving fields 12a and 12b carried out 2 ****s.

[0012] As shown in drawing 2 , the openings 13a and 13b for incorporating incident light are independently formed in these two light-receiving fields 12a and 12b. Each opening area Sa and Sb of Openings 13a and 13b is set up so that it may differ mutually, for example, may become Sa<Sb. Since the quantity of light which the direction of large light-receiving field 12b of opening area incorporates to the same incident light by this increases, in the light-receiving field 12b, sensibility becomes high rather than light-receiving field 12a. Moreover, a sensibility difference will become still bigger by arranging the lens 14 on chip only on light-receiving field 12b by the side of high sensitivity.

[0013] In addition, although it considered as the configuration which each opening area Sa and Sb of Openings 13a and 13b is changed, and arranges the lens 14 on chip only on the one where sensibility is still higher in this example in order to change the sensibility of two light-receiving fields 12a and 12b It is also possible for arranging the lens 14 on chip only on one side to give a sensibility difference between [of two] light-receiving field 12a and 12b as the opening area Sa and Sb is changed. Furthermore, it is possible to give a sensibility difference to two light-receiving fields 12a and 12b by arranging a color filter on two light-receiving fields 12a and 12b, changing the permeability of each color filter, or changing the thickness of the cascade screen on two light-receiving fields 12a and 12b, and changing permeability etc.

[0014] n perpendicular transfer registers 2-1 - 2-n are allotted for every vertical file of the to each light sensing portion 1 of the above-mentioned configuration. The flat-surface pattern of the perpendicular transfer register 2-1 - 2-n is shown in drawing 3 , and the X-X' line cross section is shown in drawing 4 , respectively. In drawing 3 and drawing 4 , the channel stop field 22 is formed along with the transfer channel 21. moreover -- the upper part of the transfer channel 21 -- gate dielectric film (SiO2) 23 -- minding -- polish recon (1Poly, 2Poly, 3Poly) of the 1st layer, the 2nd layer, and the 3rd layer from -- the becoming transfer electrodes 24, 25, and 26 are repeatedly arranged in the direction of transfer in order of the transfer electrode 24 -> transfer electrode 26 -> transfer electrode 25.

[0015] The perpendicular transfer register 2-1 of the above-mentioned configuration - 2-n are driven with the perpendicular transfer clock phiV1 to phiV6 of six phases. The perpendicular transfer clock phiV1 to phiV6 of these six phases makes a pair 2 pixels which adjoin each other in a perpendicular direction of transfer about three transfer electrodes 24, 26, and 25 prepared corresponding to one light sensing portion 1, and these six transfer electrodes are given to it as one unit.

[0016] To the transfer electrode 24 of the 1st layer corresponding to one light sensing portion 1, namely, the perpendicular transfer clock phiV1 of a plane 1 eye The perpendicular transfer clock phiV2 of eye two phases is impressed to the transfer electrode 26 of the 3rd layer, and the perpendicular transfer clock phiV3 of a three-phase-circuit eye is impressed to the transfer electrode 25 of the 2nd layer, respectively. The perpendicular transfer clock phiV5 of eye five phases is impressed to the transfer electrode 26 of the 3rd layer, and the perpendicular transfer clock phiV6 of eye six phases is impressed to the transfer electrode 25 of the 2nd layer for the perpendicular transfer clock phiV4 of eye four phases at the transfer electrode 24 of the 1st layer corresponding to the light sensing portion 1 of another side, respectively. This perpendicular transfer clock phiV1 to phiV6 takes 3 value level, and any electrode of three transfer electrodes 24, 25, and 26 can read a signal charge now by this.

[0017] In this perpendicular transfer register 2-1 - 2-n, the signal charges of the light-receiving field of the sensibility with the same light sensing portion which adjoins each other among the signal charges read for every light sensing portion sequentially from each of two light-receiving fields 12a and 12b are mixed. At this time, each signal charge of the light-receiving field where sensibility differs is arranged by turns in the perpendicular transfer register 2-1 - 2-n. And they are transmitted perpendicularly, the perpendicular transfer register 2-1 - 2-n shifting each mixed signal charge in order in a part of level blanking period. Concrete actuation of read-out of this signal charge, mixing, and a perpendicular transfer is explained to a detail later.

[0018] Corresponding to two light-receiving fields 12a and 12b where sensibility differs ahead of the direction of transfer of the perpendicular transfer register 2-1 - 2-n, two level transfer registers 3 and 4 are arranged. These two level transfer registers 3 and 4 are driven by the level transfer clock phiH1 of two phases, and phiH2, receive separately the signal charge for one line of the light-receiving field where the sensibility transmitted sequentially from the perpendicular transfer register 2-1 - 2-n differs, and transmit it horizontally one by one in the horizontal scanning period of Ushiro of a level blanking period.

[0019] For example, the level transfer register 3 by the side of the perpendicular transfer register 2-1 - 2-n transmits in order the signal charge for 2 pixels which mix the signal charges of light-receiving field 12a of low sensibility of the adjacent light sensing portion 1, and are obtained, and transmits in order the signal charge for 2 pixels which another level transfer register 4 mixes the signal charges of light-receiving field 12b of the high sensitivity of the adjacent light sensing portion 1, and are obtained. Distribution of the signal charge to these two level transfer registers 3 and 4 is performed by both the level transfer register 3 and the distribution transfer gate 5 allotted among four.

[0020] That is, as shown in drawing 5 , the signal charge transmitted to one level transfer register 3 has structure moved to the level transfer register 4 of another side through the channel field 51 controlled by the distribution transfer gate 5 from the perpendicular transfer register 2-1 - 2-n. Closing motion control of the distribution transfer gate 5 is carried out by distribution gate pulse phiHHG. In addition, the channel stop section 52 was formed in the both sides of the channel field 51, and the charge transfer to the level transfer register 4 from the level transfer register 3 corresponding to it is prevented.

[0021] When O mark shows the signal charge about light-receiving field 12a of low sensibility and - mark specifically shows the signal charge about light-receiving field 12b of high sensitivity in drawing 5 , if moved from the perpendicular transfer register 2-1 - 2-n to the level transfer register 3, in the level transfer register 3, the level transfer of signal-charge O will be carried out as it is. On the other hand, if moved from the perpendicular transfer register 2-1 - 2-n to the level transfer register 3, signal-charge - is distributed further, it will be moved to the level transfer register 4 by the transfer gate 5 through the channel field 51, and a level transfer will be carried out as it is in the level transfer register 4.

[0022] The charge detecting elements 6 and 7 of a floating diffusion amplifier configuration are formed in the edge of the destination of the level transfer registers 3 and 4, respectively. With the level transfer registers 3 and 4, these charge detecting elements 6 and 7 detect the signal charge by which the level transfer was carried out, and change it into a signal level. These two signal levels are outputted to the exterior as signal outputs OUT1 and OUT2 through buffers 8 and 9. In addition, various kinds of timing signals, such as the perpendicular transfer clock phiV1 to phiV6 of six phases, the level transfer clock phiH1 of two phases, phiH2, and distribution gate pulse phiHHG, are generated by the timing generator 10.

[0023] Between two signal outputs OUT1 and OUT2, the signal output OUT1 is a signal level based on the signal charge of light-receiving field 12a of low sensibility, and the signal output OUT2 is a signal level based on the signal charge of light-receiving field 12b of high sensitivity. These signal outputs OUT1 and OUT2 are supplied to the external digital disposal circuit 30. An example of the concrete circuitry of this digital disposal circuit 30 is shown in drawing 6 .

[0024] In drawing 6 , after sample hold of the signal output OUT1 is carried out in the sample hold (S/H) circuit 31, it is sliced with the predetermined slice level E1 in a slicing circuit 32. The output signal of this slicing circuit 32 is amplified with video amplifier 33, and serves as one input of an adder

34. Moreover, after carrying out sample hold of the signal output OUT2 in a sample hold circuit 35 and clipping it in the predetermined clip level E2 in a clipping circuit 36, it turns into an input of another side of an adder 34. An adder 34 adds both input signals and makes them a video outlet signal. The property of a video outlet signal over the amount of incident light is shown in drawing 7 .

[0025] As mentioned above, after clipping the output signal based on the signal charge of light-receiving field 12b of high sensitivity in the predetermined clip level E2, By adding with the output signal based on the signal charge of light-receiving field 12a of low sensibility which was sliced with the predetermined slice level E1, and was amplified with video amplifier 33, and having made it derive as a video outlet Since a clip is hung with the common clip level E2 to the output signal based on the signal charge of light-receiving field 12b of high sensitivity, it can control that originate in the property variation between pixels and the nonuniformity of a fixed pattern occurs in an image.

[0026] In addition, in the array configuration of a pixel, the CCD solid state camera concerning this operation gestalt of a configuration of having divided each light sensing portion 1 into two, and having arranged light-receiving field 12a of low sensibility and light-receiving field 12b of high sensitivity by turns in a perpendicular direction of transfer is the same as the conventional CCD solid state camera and conventional conceptual target of a configuration of having arranged the high sensitivity pixel 101 and the low sensibility pixel 102 by turns in a perpendicular direction of transfer, as shown in drawing 18 . However, in this operation gestalt, it is characterized [one] by the configuration which divided one light sensing portion (pixel) 1 in the channel stop field 11.

[0027] Thus, micro processing of a pixel becomes possible by dividing one light sensing portion 1 in the channel stop field 11, and taking the configuration which has arranged light-receiving field 12a of low sensibility, and light-receiving field 12b of high sensitivity by turns in a perpendicular direction of transfer. Thereby, the formation of many pixels and miniaturization of a CCD solid state camera can be attained.

[0028] Moreover, although vertical resolution falls to one half by having mixed the signal charges of a light-receiving field which have the same sensibility in 2 pixels (light sensing portion) which adjoins each other in a perpendicular direction of transfer, conventional field read-out and conventional frame read-out can be realized.

[0029] concrete actuation of read-out of the signal charge from the following and two light-receiving fields 12a and 12b, mixing, and a perpendicular transfer -- attaching -- field read-out and frame read-out -- a case -- dividing -- carrying out -- explaining . In addition, in the perpendicular transfer register 2-1 shown in drawing 3 - 2-n, the perpendicular transfer clock phiV1 to phiV6 of six phases takes 3 value level, as point ** was carried out. That is, three values of a high level (it is hereafter described as "H" level), middle level (it is hereafter described as "M" level), and a low (it is hereafter described as "L" level) are taken, and it has composition of any electrode of three transfer electrodes 24, 25, and 26 which a signal charge can read by this.

[0030] First, actuation of the odd number field in field read-out is explained with reference to the timing chart of drawing 8 based on the explanatory view of drawing 9 of operation. First, in a perpendicular blanking period, if the perpendicular transfer clock phiV3 and phiV6 are set to "H" level, since the potential under the transfer electrode 25 of the 2nd layer will become deep in 2-pixel adjacent each, the signal charge (O mark shows among drawing and suppose that it is the same as that of the following) accumulated in light-receiving field 12b of high sensitivity is read to the bottom of the transfer electrode 25 (t=t1). At this time, both the perpendicular transfer clock phiV1, phiV2, phiV4, and phiV5 are in "L" level.

[0031] Then, the perpendicular transfer clock phiV3, phiV4, and phiV5 change on "L" level through "M" level in order. That is, the perpendicular transfer clock phiV3 changes on ""M" level from H" level, and changes on fixed time amount "after L" level further. Next, the perpendicular transfer clock phiV4 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V3] Then, the perpendicular transfer clock phiV5 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V4]

[0032] Thus, when the perpendicular transfer clock phiV3, phiV4, and phiV5 change on "L" level via "M" level in order, the perpendicular transfer of the signal charge under the transfer electrode 25 with which the perpendicular transfer clock phiV3 was impressed is carried out. Since the perpendicular transfer clock phiV6 continued and it was in "M" level at this time, when the perpendicular transfer clock phiV5 changes on "M" "L" level from level (t=t2) The signal charge transmitted from under the transfer electrode 25 with which the perpendicular transfer clock phiV3 was impressed is moved to the bottom of the transfer electrode 25 with which the perpendicular transfer clock phiV6 was impressed, and the signal charges by the side of high sensitivity are mixed in 2 pixels which therefore adjoins each other.
[0033] Next, if the perpendicular transfer clock phiV2 and phiV4 are set to "H" level, since the potential under one 2-pixel transfer electrode 26 of the 3rd layer and the transfer electrode 24 of the 1st layer of another side will become deep, the signal charge (x mark shows among drawing and suppose that it is the same as that of the following) accumulated in light-receiving field 12a of low sensibility is read to the bottom of the transfer electrodes 26 and 24 (t=t3). At this time, both the perpendicular transfer clock phiV1, phiV3, and phiV5 are in "L" level, and the perpendicular transfer clock phiV6 is in "M" level.
[0034] Then, the perpendicular transfer clock phiV2 and phiV3 change on "L" level through "M" level in order. That is, the perpendicular transfer clock phiV2 changes on ""M" level from H" level, and changes on fixed time amount "after L" level further. Next, the perpendicular transfer clock phiV3 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V2]
[0035] Thus, when the perpendicular transfer clock phiV2 and phiV3 change on "L" level via "M" level in order, the perpendicular transfer of the signal charge under the transfer electrode 26 with which the perpendicular transfer clock phiV2 was impressed is carried out. Since the perpendicular transfer clock phiV4 continued and it was in "M" level at this time, when the perpendicular transfer clock phiV3 changes on "M" "L" level from level (t=t4) The signal charge transmitted from under the transfer electrode 26 with which the perpendicular transfer clock phiV2 was impressed is moved to the bottom of the transfer electrode 24 with which the perpendicular transfer clock phiV4 was impressed, and the signal charges by the side of low sensibility are mixed in 2 pixels which therefore adjoins each other.
[0036] In this condition, the same signal charge of the light-receiving fields of sensibility mixed in 2 pixels which adjoins each other in a perpendicular direction, i.e., signal-charge [by the side of high sensitivity] O and signal-charge x by the side of low sensibility, will be arranged by turns for every line. Henceforth, it shifts to the Rhine shift period and a perpendicular transfer is performed. And in drawing 1 , signal-charge O by the side of high sensitivity is moved to the level transfer register 3 by the level transfer register 4 per Rhine through the level transfer register 3 and the distribution transfer gate 5, respectively, and the level transfer of signal-charge x by the side of low sensibility is carried out after that.
[0037] Then, actuation of the even number field in field read-out is explained with reference to the timing chart of drawing 10 based on the explanatory view of drawing 11 of operation. In a perpendicular blanking period, if the perpendicular transfer clock phiV3 and phiV6 are set to "H" level, since the potential under the transfer electrode 25 of the 2nd layer will become deep in 2-pixel adjacent each, the signal charge accumulated in light-receiving field 12b of high sensitivity is read to the bottom of the transfer electrode 25 (t=t5). At this time, both the perpendicular transfer clock phiV1, phiV2, phiV4, and phiV5 are in "L" level.
[0038] Then, the perpendicular transfer clock phiV6, phiV1, and phiV2 change on "L" level through "M" level in order. That is, the perpendicular transfer clock phiV6 changes on ""M" level from H" level, and changes on fixed time amount "after L" level further. Next, the perpendicular transfer clock phiV1 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V6] Then, the perpendicular transfer clock phiV2 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V1]
[0039] Thus, the perpendicular transfer of the signal charge under the transfer electrode 25 with which

the perpendicular transfer clock phiV6 was impressed is carried out because the perpendicular transfer clock phiV6, phiV1, and phiV2 change on "L" level via "M" level in order. Since the perpendicular transfer clock phiV3 continued and it was in "M" level at this time, when the perpendicular transfer clock phiV2 changes on "M" "L" level from level (t=t6) The signal charge transmitted from under the transfer electrode 25 with which the perpendicular transfer clock phiV6 was impressed It is moved to the bottom of the transfer electrode 25 with which the perpendicular transfer clock phiV3 was impressed, and the signal charges by the side of high sensitivity are mixed in 2 pixels which adjoins each other in a combination different therefore from the case of the odd number field.

[0040] Next, if the perpendicular transfer clock phiV1 and phiV5 are set to "H" level, since the potential under adjacent one 2-pixel transfer electrode 24 of the 1st layer and the transfer electrode 26 of the 3rd layer of another side will become deep, the signal charge accumulated in light-receiving field 12a of low sensibility is read to the bottom of the transfer electrodes 24 and 26 (t=t7). At this time, both the perpendicular transfer clock phiV2, phiV4, and phiV6 are in "L" level, and the perpendicular transfer clock phiV3 is in "M" level.

[0041] Then, the perpendicular transfer clock phiV5 and phiV6 change on "L" level through "M" level in order. That is, the perpendicular transfer clock phiV5 changes on ""M" level from H" level, and changes on fixed time amount "after L" level further. Next, the perpendicular transfer clock phiV6 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V5]

[0042] Thus, when the perpendicular transfer clock phiV5 and phiV6 change on "L" level via "M" level in order, the perpendicular transfer of the signal charge under the transfer electrode 26 with which the perpendicular transfer clock phiV5 was impressed is carried out. Since the perpendicular transfer clock phiV1 continued and it was in "M" level at this time, when the perpendicular transfer clock phiV6 changes on "M" "L" level from level (t=t8) The signal charge transmitted from under the transfer electrode 26 with which the perpendicular transfer clock phiV5 was impressed It is moved to the bottom of the transfer electrode 24 with which the perpendicular transfer clock phiV1 was impressed, and the signal charges by the side of low sensibility are mixed in 2 pixels which adjoins each other in a combination different therefore from the case of the odd number field. Henceforth, it shifts to the Rhine shift period and a perpendicular transfer and a level transfer are performed like the case of the odd number field.

[0043] Next, actuation of the odd number field in frame read-out is explained with reference to the timing chart of drawing 12 based on the explanatory view of drawing 13 of operation. First, in a perpendicular blanking period, if the perpendicular transfer clock phiV6 is set to "H" level, since the potential under every other pixel transfer electrode 25 of the 2nd layer will become deep in a perpendicular direction, the signal charge accumulated in light-receiving field 12b of high sensitivity is read to the bottom of the transfer electrode 25 at intervals of a pixel (t=t1). At this time, both the perpendicular transfer clocks phiV1 to phiV5 are in "L" level.

[0044] Then, the perpendicular transfer clock phiV6, phiV1, and phiV2 change on "L" level through "M" level in order. That is, the perpendicular transfer clock phiV6 changes on ""M" level from H" level, and changes on fixed time amount "after L" level further. Next, the perpendicular transfer clock phiV1 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V6] Then, the perpendicular transfer clock phiV2 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V1]

[0045] Thus, when the perpendicular transfer clock phiV6, phiV1, and phiV2 change on "L" level via "M" level in order, the perpendicular transfer of the signal charge under the transfer electrode 25 with which the perpendicular transfer clock phiV6 was impressed is carried out. this time -- the perpendicular transfer clock phiV3 -- "M" -- the perpendicular transfer clock phiV2 since it is in level -- "L" from "M" level -- when it changes on level (t=t2), the signal charge transmitted from under the transfer electrode 25 with which the perpendicular transfer clock phiV6 was impressed is moved to the bottom of the transfer electrode 25 with which the perpendicular transfer clock phiV3 was impressed, and is

accumulated here.
[0046] Next, if the perpendicular transfer clock phiV5 is set to "H" level, since the potential under the transfer electrode 26 of the 3rd layer of the pixel of light-receiving field 12b of the high sensitivity read previously will become deep, the signal charge accumulated in light-receiving field 12a of low sensibility of the pixel concerned is read to the bottom of the transfer electrode 26 (t=t3). At this time, both the perpendicular transfer clock phiV1, phiV2, and phiV4 are in "L" level, and both the perpendicular transfer clock phiV3 and phiV6 are in "M" level.
[0047] moreover, the perpendicular transfer clock phiV5 -- "M" -- if set to level, since the potential under the transfer electrode 25 with which the potential and the perpendicular transfer clock phiV6 under the transfer electrode 26 with which the perpendicular transfer clock phiV5 was impressed were impressed will serve as this level, signal-charge x read from light-receiving field 12a of low sensibility is stored in the bottom of the transfer electrode 26 and the transfer electrode 25. And if the perpendicular transfer clock phiV5 is set to "L" level, the potential under the transfer electrode 26 will become shallow, and signal-charge x of light-receiving field 12a of low sensibility will be stored in the bottom of the transfer electrode 25 (t=t4).
[0048] In this condition, signal-charge O by the side of the high sensitivity read at intervals of a pixel in the perpendicular direction and signal-charge x by the side of low sensibility will be arranged by turns for every line. Henceforth, it shifts to the Rhine shift period and a perpendicular transfer is performed. And in drawing 1 , signal-charge O by the side of high sensitivity is moved to the level transfer register 3 by the level transfer register 4 per Rhine through the level transfer register 3 and the distribution transfer gate 5, respectively, and the level transfer of signal-charge x by the side of low sensibility is carried out after that.
[0049] Next, actuation of the even number field in frame read-out is explained with reference to the timing chart of drawing 14 based on the explanatory view of drawing 15 of operation. First, in a perpendicular blanking period, if the perpendicular transfer clock phiV3 is set to "H" level, since the potential under the transfer electrode 25 of the 2nd layer of the pixel which shifted from the case of the odd number field one line will become deep, the signal charge accumulated in light-receiving field 12b of high sensitivity is read to the bottom of the transfer electrode 25 at intervals of a pixel (t=t5). At this time, both the perpendicular transfer clock phiV1, phiV2, phiV4, phiV5, and phiV6 are in "L" level.
[0050] Then, the perpendicular transfer clock phiV3, phiV4, and phiV5 change on "L" level through "M" level in order. That is, the perpendicular transfer clock phiV3 changes on ""M" level from H" level, and changes on fixed time amount "after L" level further. Next, the perpendicular transfer clock phiV4 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V3] Then, the perpendicular transfer clock phiV5 changes on "L" "M" level from level within the period of perpendicular transfer clock phi"M" level, and changes on fixed time amount "after L" level further. [of V4]
[0051] Thus, when the perpendicular transfer clock phiV3, phiV4, and phiV5 change on "L" level via "M" level in order, the perpendicular transfer of the signal charge under the transfer electrode 25 with which the perpendicular transfer clock phiV3 was impressed is carried out. this time -- the perpendicular transfer clock phiV6 -- "M" -- the perpendicular transfer clock phiV5 since it is in level -- "L" from "M" level -- when it changes on level (t=t6), the signal charge transmitted from under the transfer electrode 25 with which the perpendicular transfer clock phiV3 was impressed is moved to the bottom of the transfer electrode 25 with which the perpendicular transfer clock phiV6 was impressed, and is accumulated here.
[0052] Next, if the perpendicular transfer clock phiV2 is set to "H" level, since the potential under the transfer electrode 26 of the 3rd layer of the pixel of light-receiving field 12b of the high sensitivity read previously will become deep, the signal charge accumulated in light-receiving field 12a of low sensibility of the pixel concerned is read to the bottom of the transfer electrode 26 (t=t7). At this time, both the perpendicular transfer clock phiV1, phiV4, and phiV5 are in "L" level, and both the perpendicular transfer clock phiV3 and phiV6 are in "M" level.
[0053] moreover, the perpendicular transfer clock phiV2 -- "M" -- if set to level, since the potential

under the transfer electrode 25 with which the potential and the perpendicular transfer clock phiV3 under the transfer electrode 26 with which the perpendicular transfer clock phiV2 was impressed were impressed will serve as this level, signal-charge x read from light-receiving field 12a of low sensibility is stored in the bottom of the transfer electrode 26 and the transfer electrode 25. And if the perpendicular transfer clock phiV2 is set to "L" level, the potential under the transfer electrode 26 will become shallow, and signal-charge x of light-receiving field 12a of low sensibility will be stored in the bottom of the transfer electrode 25 (t=t8). Henceforth, it shifts to the Rhine shift period and a perpendicular transfer and a level transfer are performed like the case of the odd number field.

[0054] Drawing 16 is the outline block diagram showing other operation gestalten of this invention, among drawing, gives the same sign to drawing 1 and an equivalent part, and is shown. In drawing 16 , each light sensing portion 1 by which two-dimensional arrangement was carried out consists matrix-like of two light-receiving fields 12a and 12b where sensibility differs. Moreover, while mixing and carrying out the perpendicular transfer of the signals of the light-receiving field of the sensibility with the same light sensing portion which adjoins each other among the signal charges read from each of two light-receiving fields 12a and 12b for every light sensing portion within the perpendicular transfer register 2-1 - 2-n The configuration until it distributes to two level transfer registers 3 and 4 and carries out a level transfer separately by the distribution transfer gate 5 is completely the same as the case of a previous operation gestalt.

[0055] And it differs from the previous operation gestalt at the point described below. That is, in this operation gestalt, while forming a limiter 61 beside the outgoing end section of the level transfer register 7 which carries out the level transfer of the signal charge of light-receiving field 12b of high sensitivity, it has the composition of having formed the charge detecting element 62 and the buffer 63 in common to two level transfer registers 3 and 4. The charge detecting element 62 receives the signal charge of light-receiving field 12b of the high sensitivity which it has floating diffusion amplifier composition, and the level transfer was carried out with the signal charge of light-receiving field 12a of low sensibility by which the level transfer was carried out with the level transfer register 3, and the level transfer register 4, and was clipped by the limiter 61, and mixes both signal charges, and changes and outputs them to a signal level.

[0056] The Y-Y' line cross section of drawing 16 shows an example of the concrete configuration of a limiter 61 to drawing 17 . In drawing 17 , the outgoing end section of the level transfer register 4 is constituted by forming the level CCD channel 65 of the N type impurity layer formed in the front-face side of the P type well field 64, and arranging the level transfer electrode 67 through gate dielectric film 66 on it by it. The outgoing end section of this level transfer register 4 is adjoined, and it is N. - The drain 69 which consists of overflow barrier 68 which consists of a mold impurity layer, and an N type impurity layer is formed, and the limiter 61 is constituted by this overflow barrier 68 and drain 69. The predetermined direct current voltage E0 is impressed to the drain 69.

[0057] It sets to the limiter 61 of the above-mentioned configuration, and is N. - The height of the potential of the overflow barrier 68 is decided by concentration of a mold impurity layer etc., and the height of this potential serves as clip level with it. And in the level transfer register 4, if the amount of charges exceeds clip level when the signal charge of light-receiving field 12b of high sensitivity is transmitted in order and accumulated in the packet beside a limiter 61, a limiter will be hung to the signal charge of light-receiving field 12b of high sensitivity by the charge to have exceeded being thrown away into a drain 69. In addition, in drawing 17 , the direction of transfer of the level transfer register 4 is a right-angled direction to space.

[0058] As mentioned above, in the CCD solid state camera concerning this operation gestalt The inside of the signal charge read from each of two light-receiving fields 12a and 12b for every light sensing portion, While mixing and carrying out the perpendicular transfer of the signals of the light-receiving field of the sensibility with the same adjacent light sensing portion within the perpendicular transfer register 2-1 - 2-n, and distributing to two level transfer registers 3 and 4 and carrying out a level transfer separately by the distribution transfer gate 5 By clipping by the limiter 61 about the signal charge of light-receiving field 12b of high sensitivity, and having made it mix with the signal charge of light-

receiving field 12a of the low sensibility in the floating diffusion capacity of the charge detecting element 62 after an appropriate time Since a limiter is hung by the common limiter 61 to each signal charge of light-receiving field 12b of high sensitivity, it can control that originate in the property variation between pixels and the nonuniformity of a fixed pattern occurs in an image.

[0059] In addition, although considered as the configuration which hangs a limiter to the signal charge of light-receiving field 12b of high sensitivity within the level transfer register 7 by the limiter 61 with this operation gestalt, it is also possible to hang a limiter to the signal charge of light-receiving field 12b of high sensitivity within the charge detecting element 62.

[0060] Namely, while transmitting the signal charge of light-receiving field 12a of low sensibility, and the signal charge of light-receiving field 12b of high sensitivity to the charge detecting element 62 by turns from two level transfer registers 3 and 4 in the form with which the high sensitivity side was made to precede In the charge detecting element 62, as a reset pulse which resets floating diffusion capacity What is necessary is to set up 3 value level containing clamp level, to clip the signal charge by the side of the high sensitivity previously transmitted from the level transfer register 4 with the clamp level, to mix with the signal charge by the side of the low sensibility transmitted from the level transfer register 3 after that, to change into a signal level, and just to make it output.

[0061] In addition, in each above-mentioned operation gestalt, although the case of a configuration of having divided each light sensing portion 1 into two to the light-receiving field to which sensibility differs was explained, it is also possible to divide into three or more light-receiving fields to which it is not comparatively limited for 2 minutes, and sensibility differs. In this case, since a level transfer register also needs to transmit the signal charge corresponding to each sensibility separately, only the number corresponding to the number of partitions of a light-receiving field is needed. Moreover, if it hits hanging a limiter, what is necessary is just made to carry out to signal charges other than the signal charge of the light-receiving field of figure of merit, or the signal based on it at least.

[0062]

[Effect of the Invention] As explained above, according to this invention, each light sensing portion is divided into two or more light-receiving fields to which sensibility differs. The inside of the signal charge read from each of two or more light-receiving fields for every light sensing portion, While carrying out the level transfer of the signal charge of the light-receiving field where the perpendicular transfer of the signal charges of the light-receiving field of the sensibility with the same adjacent light sensing portion is mixed and carried out within a perpendicular transfer register, and sensibility differs separately with two or more level transfer registers By having clipped signal charges other than the signal charge of the light-receiving field of figure of merit, or the signal based on it at least, mixing or adding and having made it output the signal charge of the light-receiving field of other sensibility, or the signal based on it A dynamic range can be expanded without generating the fixed pattern noise resulting from the nonuniformity of the amount Qs of saturation charges of each pixel, since a clamp is performed with common clamp level to each signal charge by the side of high sensitivity, or the signal based on it.

[Translation done.]